

FIG. 1A

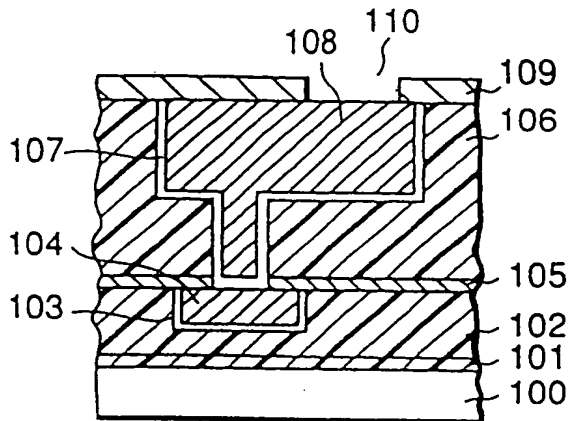


FIG. 1D

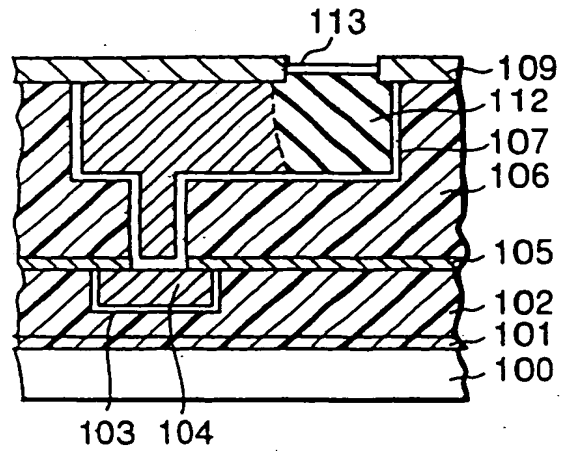


FIG. 1B

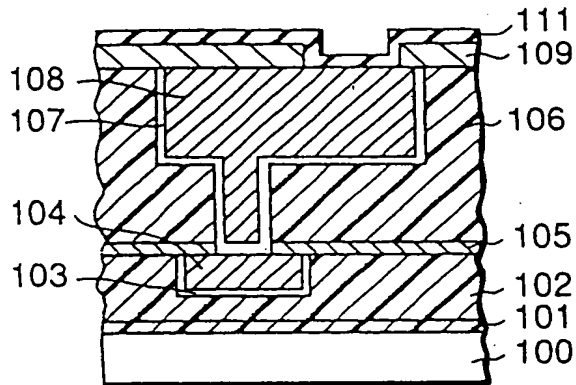


FIG. 1E

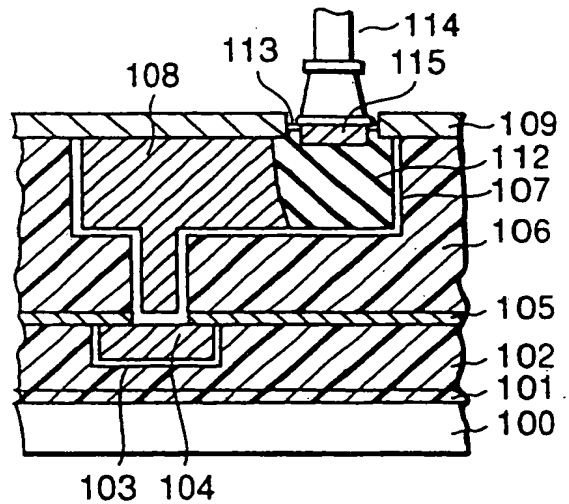


FIG. 1C

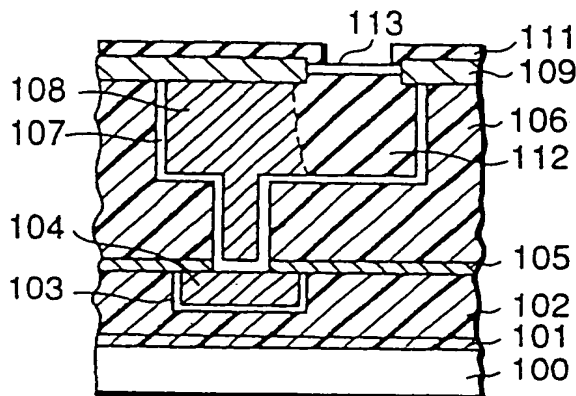


FIG. 2

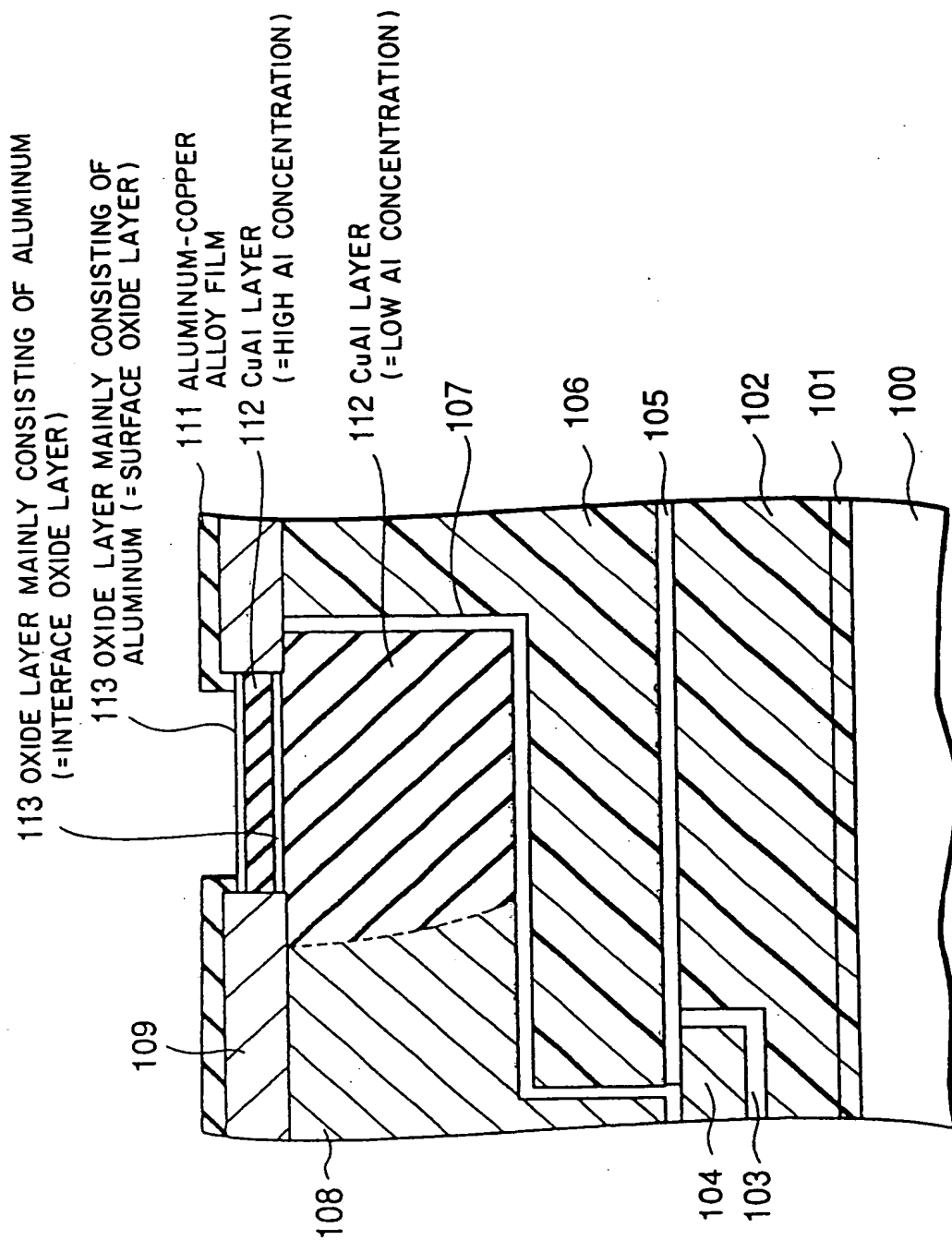


FIG. 3

Al CONCENTRATION IN SURFACE LAYER OF CuAl LAYER AND BONDING PROPERTIES

| Al CONCENTRATION IN SURFACE LAYER | 0.5% | 1% | 1.5% | 2% | 2.5% | 3% | 4% |
|--------------------------------------|------|----|------|----|------|----|----|
| BONDING PROPERTIES | x | x | Δ | ○ | ○ | ○ | ○ |

FIG. 4A

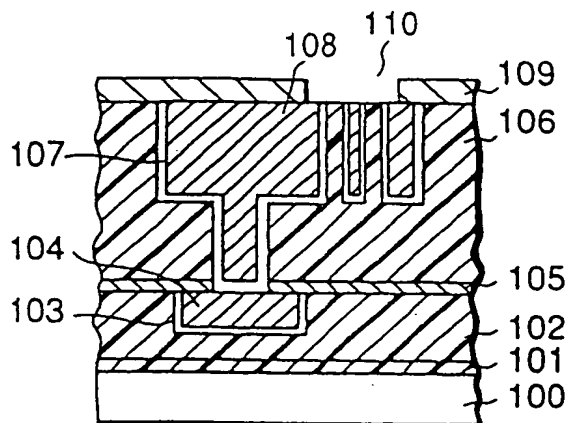


FIG. 4D

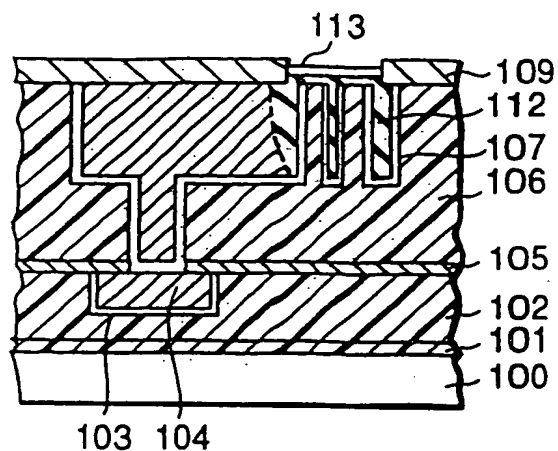


FIG. 4B

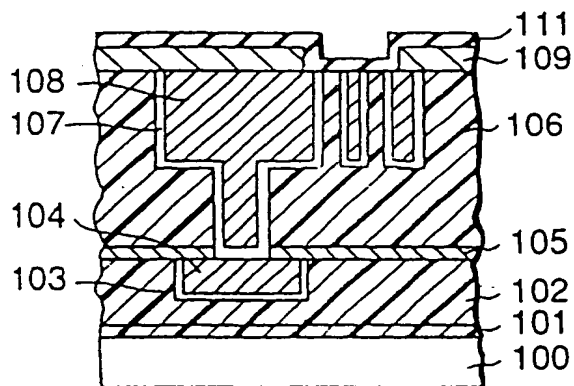


FIG. 4E

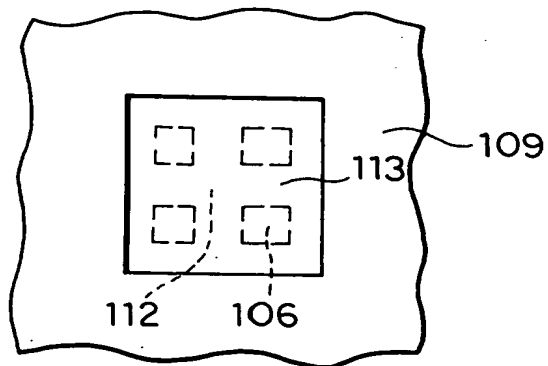


FIG. 4C

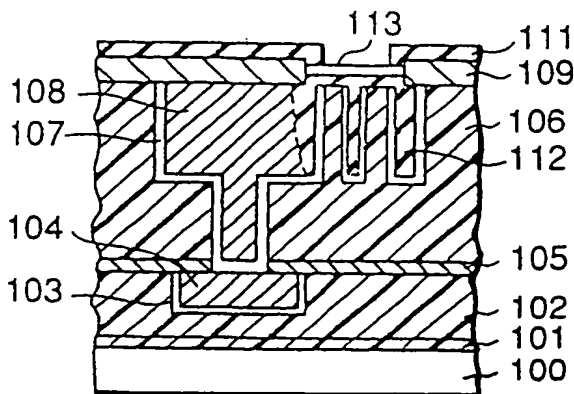


FIG. 5A

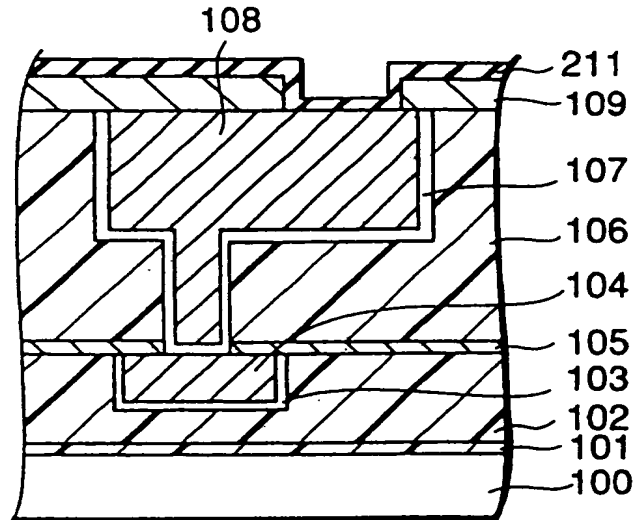


FIG. 5B

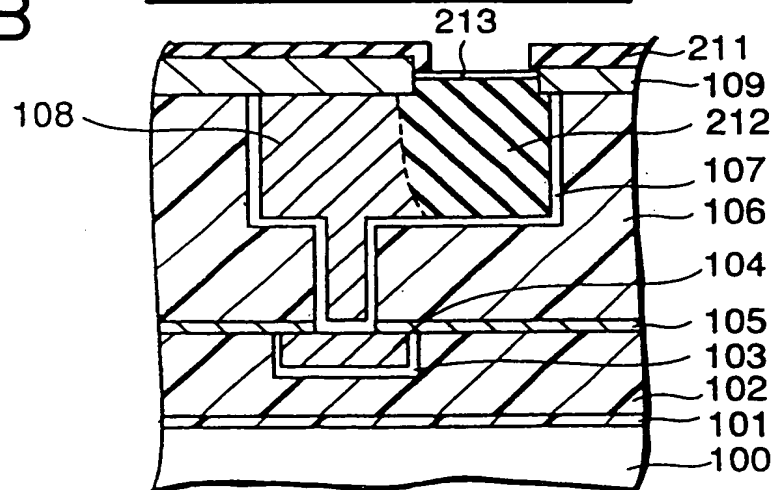


FIG. 5C

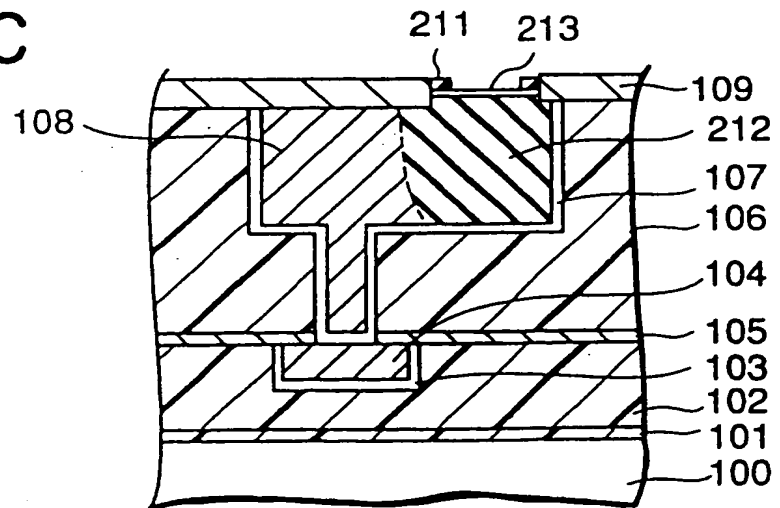


FIG. 6A

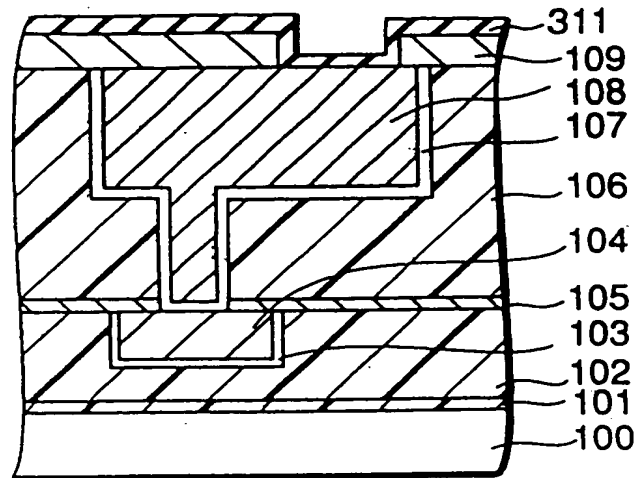


FIG. 6B

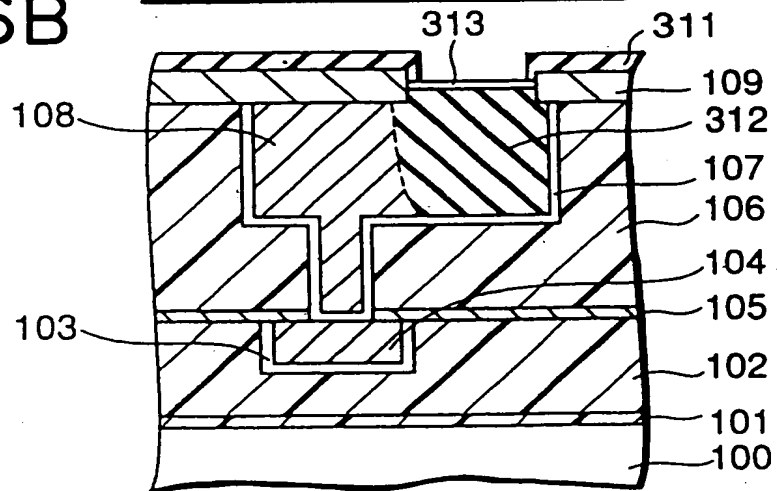


FIG. 6C

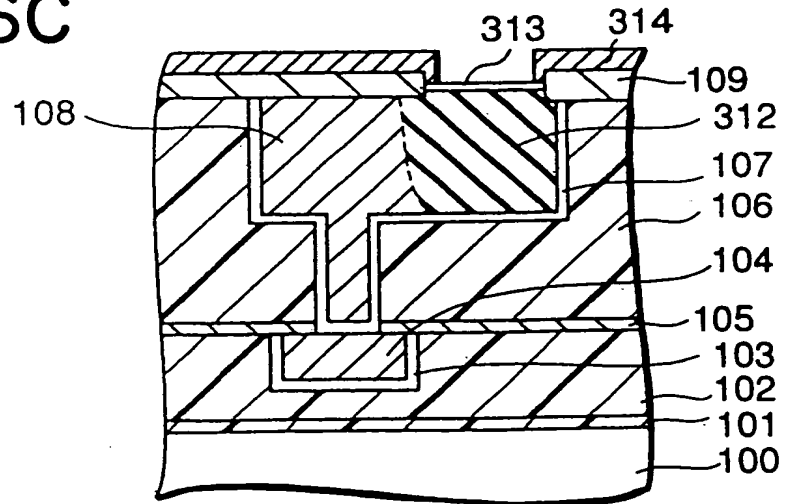


FIG. 7A

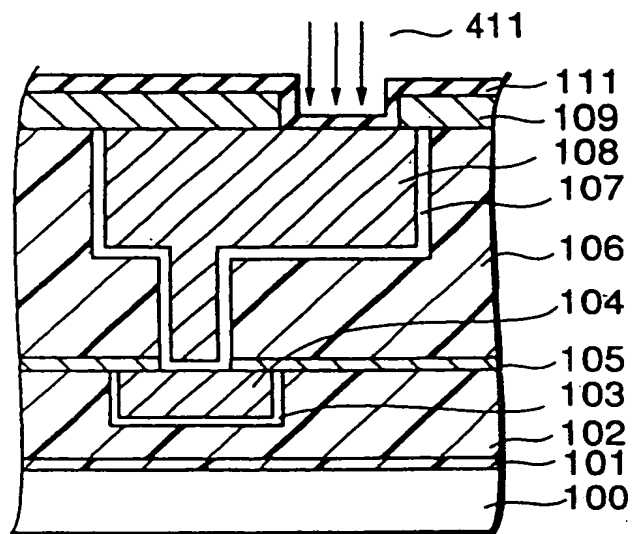


FIG. 7B

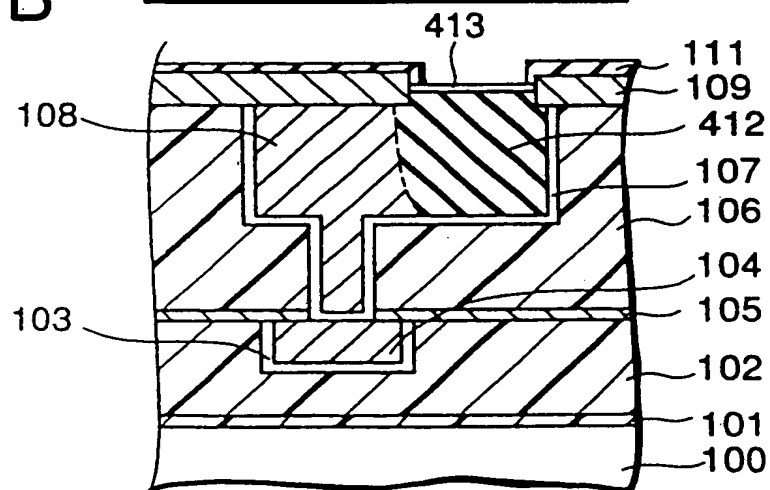


FIG. 7C

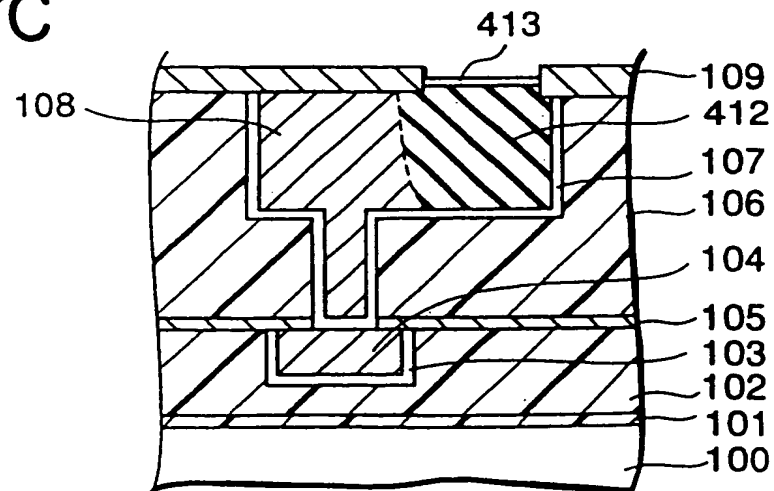


FIG. 8A

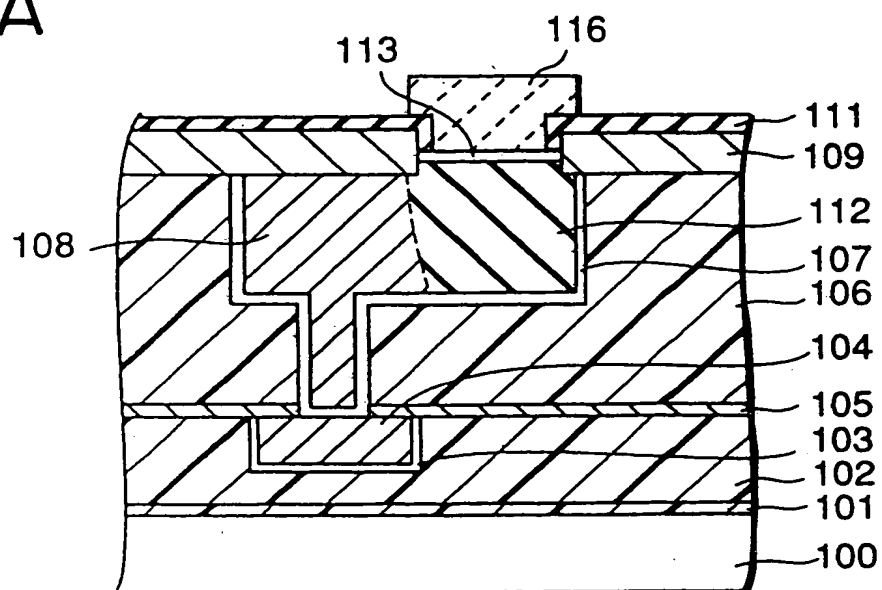


FIG. 8B

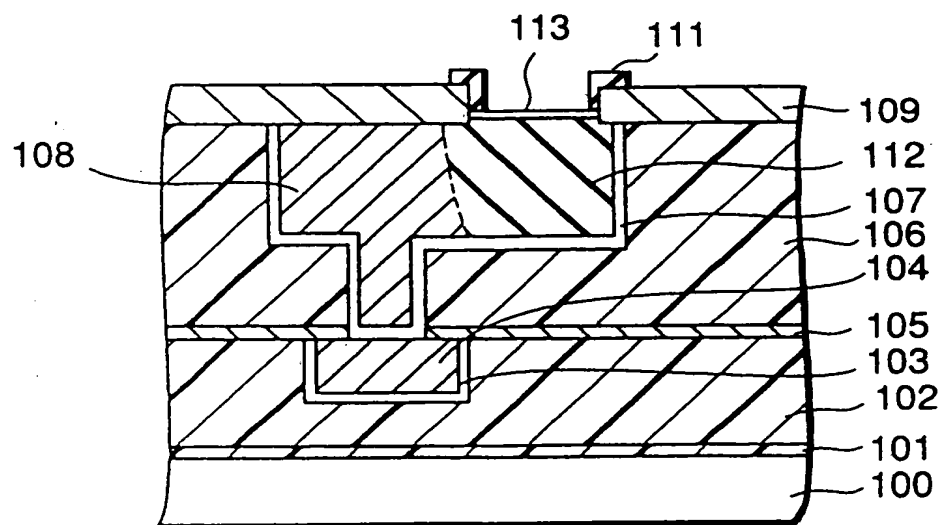


FIG. 9A

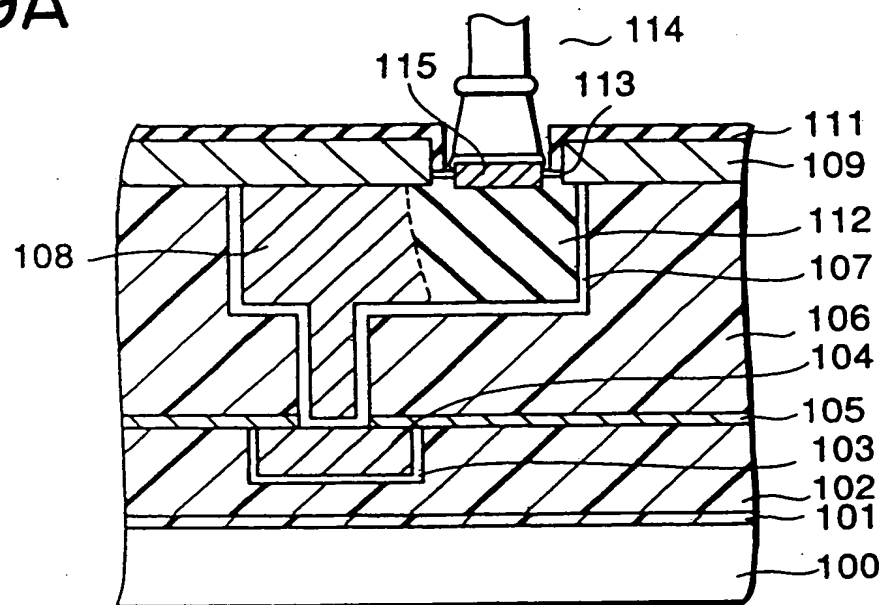


FIG. 9B

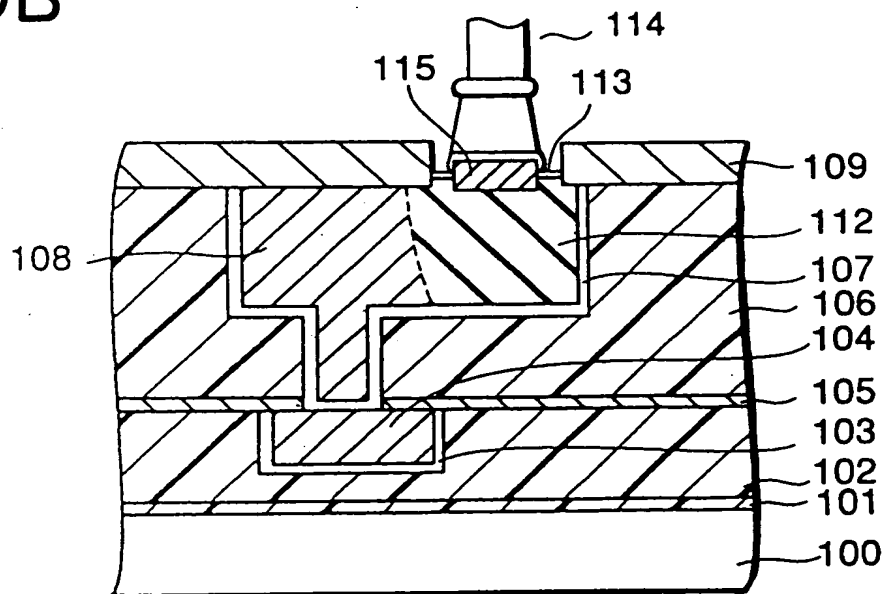


FIG. 10

SHEAR TEST

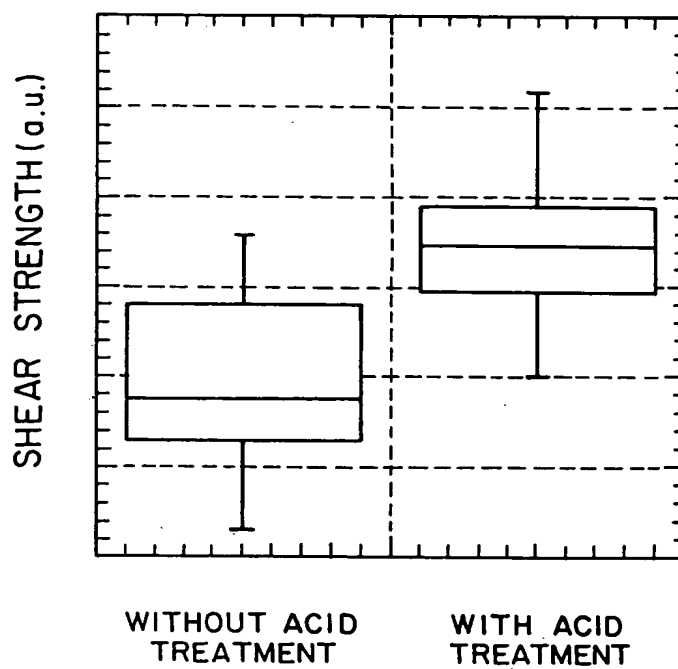


FIG. 1IA

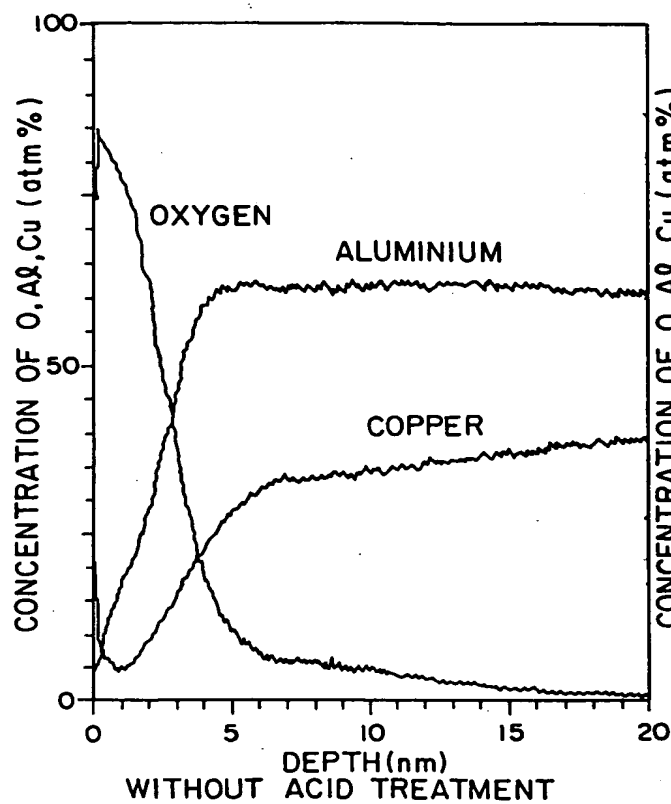


FIG. 1IB

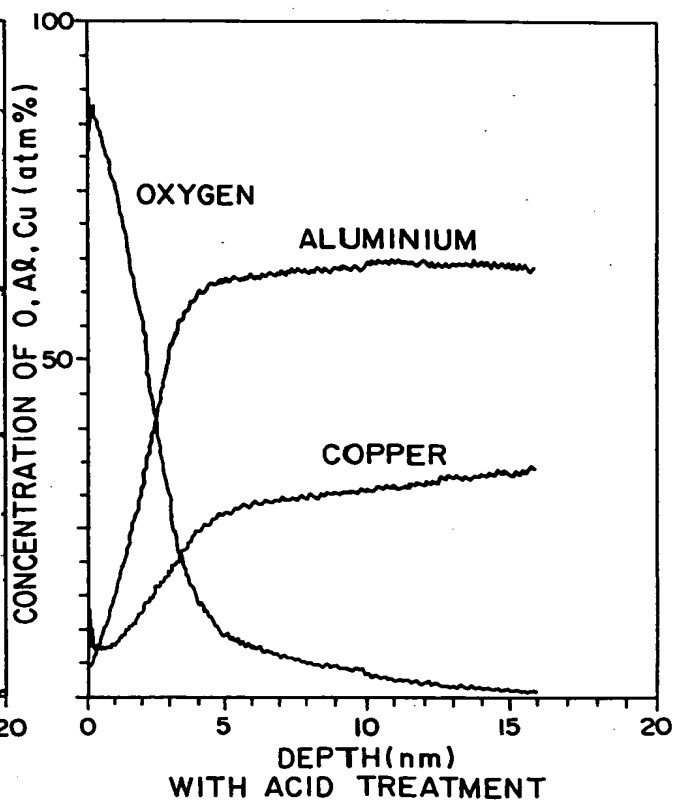


FIG. 1IC

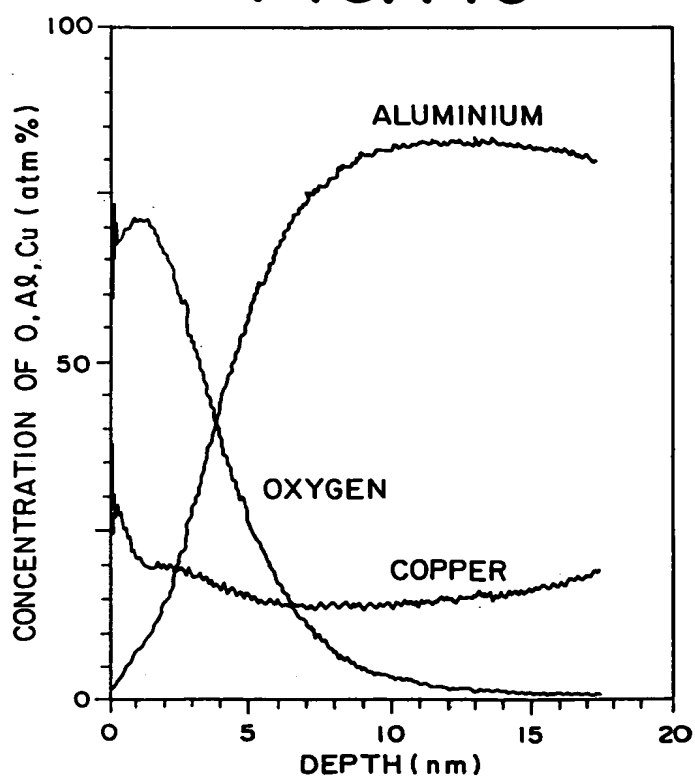


FIG. 12

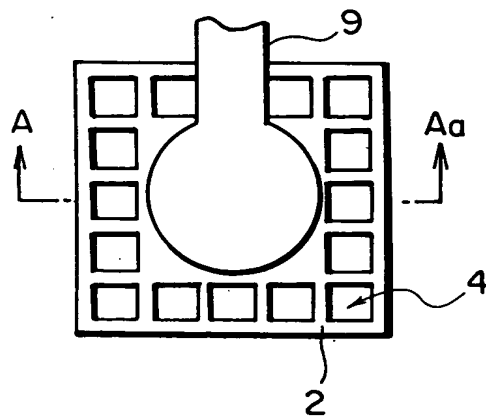


FIG. 13

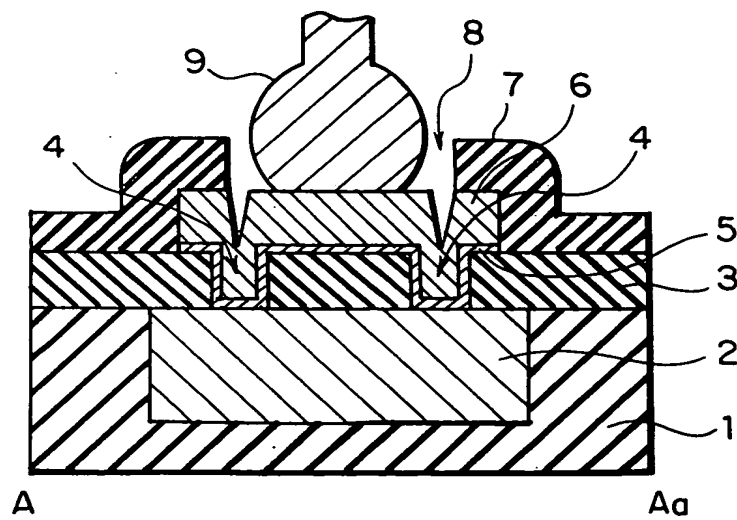


FIG. 14

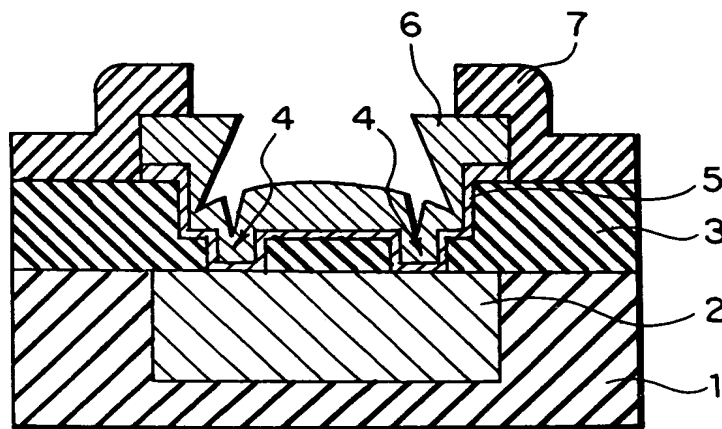


FIG. 15

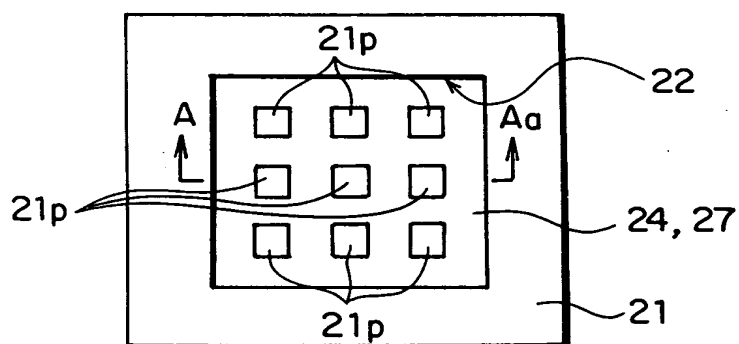


FIG. 16

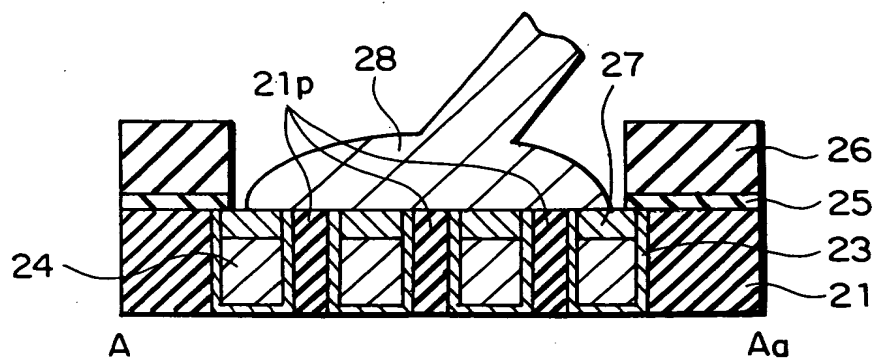


FIG. 17A

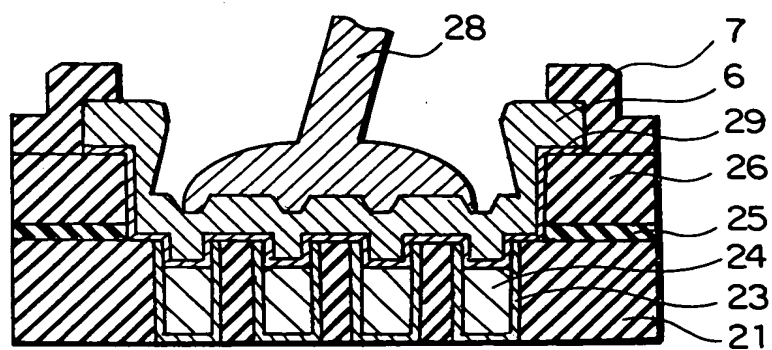


FIG. 17B

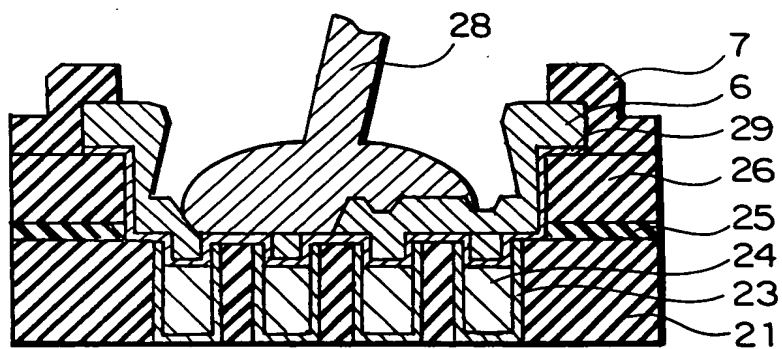


FIG. 18A

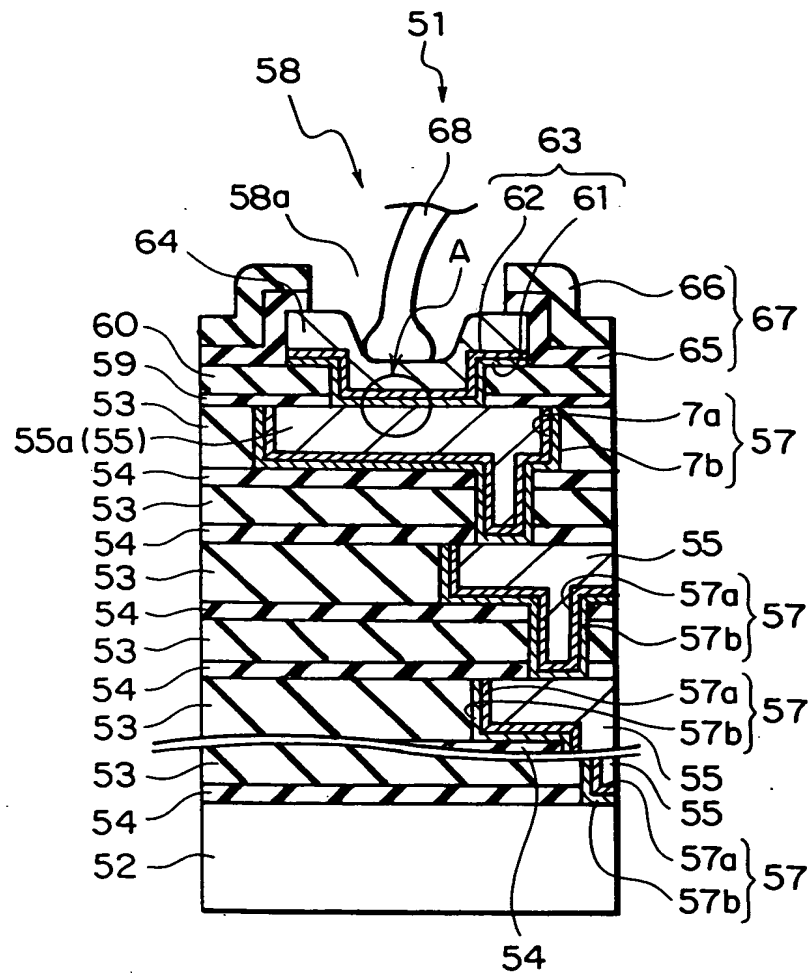


FIG. 18B

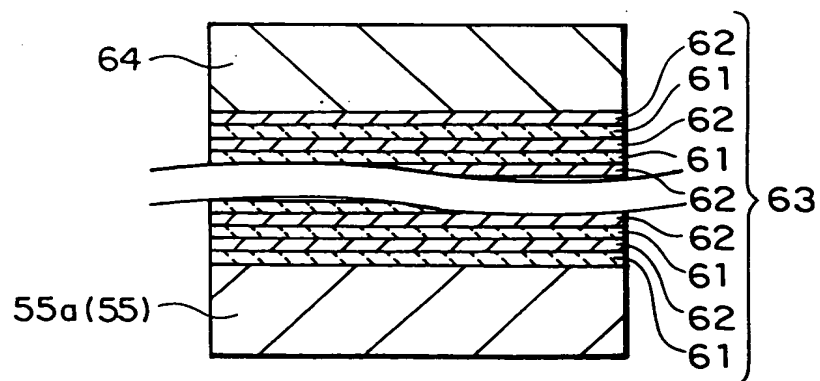


FIG. 19A

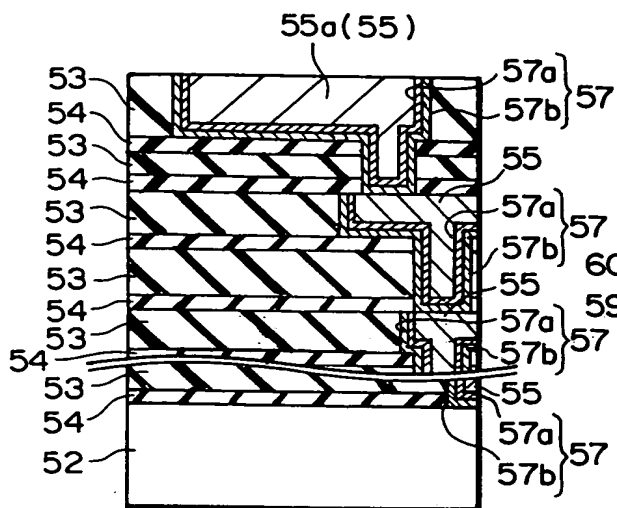


FIG. 19D

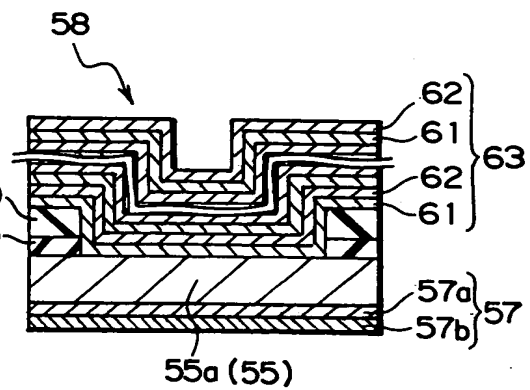


FIG. 19B

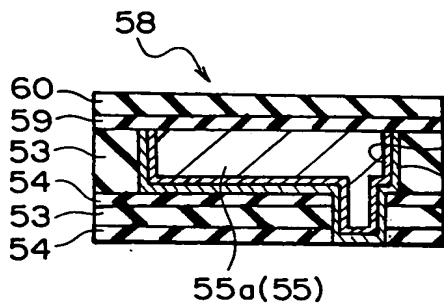


FIG. 19E

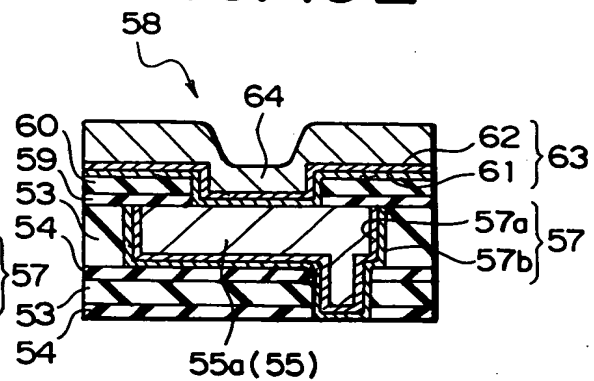


FIG. 19C

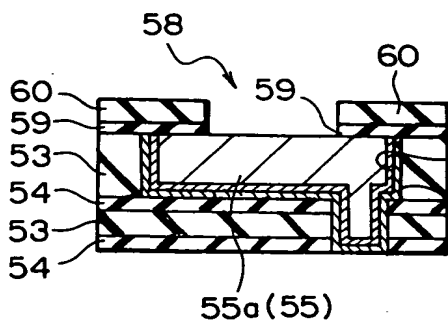


FIG. 19F

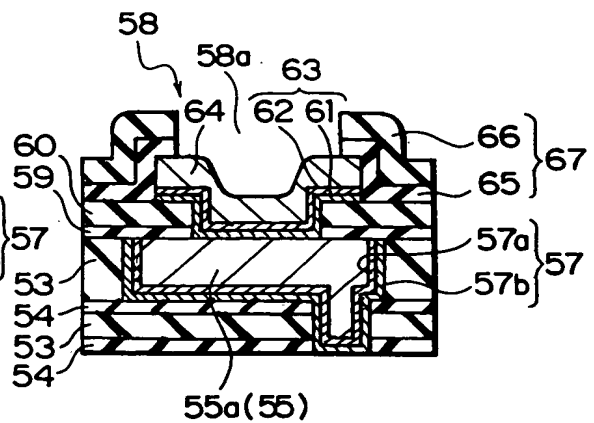


FIG. 20

| | | | | | | |
|--------------------------------------|----|---|---|----|----|----|
| Ta ₂ N FILM THICKNESS(nm) | 60 | 3 | 5 | 10 | 30 | 60 |
| Ta FILM THICKNESS(nm) | 10 | 3 | 5 | 10 | 30 | 60 |
| LAMINATION CYCLE(TIMES) | 1 | 1 | 1 | 1 | 1 | 1 |
| Cu/Al BARRIER PROPERTIES | O | x | x | x | x | O |
| POST-BONDING BARRIER PROPERTIES | x | x | x | x | x | x |
| POST-BONDING ADHESION PROPERTIES | x | x | x | x | x | x |
| DUST | O | O | O | O | O | O |

FIG. 21

| | | | | | |
|--------------------------------------|---|---|----|----|----|
| Ta ₂ N FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| Ta FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| LAMINATION CYCLE(TIMES) | 2 | 2 | 2 | 2 | 2 |
| Cu/Al BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING ADHESION PROPERTIES | x | O | O | O | O |
| DUST | O | O | O | O | x |

FIG. 22

| | | | | | |
|--------------------------------------|---|---|----|----|----|
| Ta ₂ N FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| Ta FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| LAMINATION CYCLE(TIMES) | 3 | 3 | 3 | 3 | 3 |
| Cu/Al BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING ADHESION PROPERTIES | x | O | O | O | O |
| DUST | O | O | O | O | x |

FIG. 23

| | | | | | |
|--------------------------------------|---|---|----|----|----|
| Ta ₂ N FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| Ta FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| LAMINATION CYCLE(TIMES) | 6 | 6 | 6 | 6 | 6 |
| Cu/Al BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING ADHESION PROPERTIES | x | O | O | O | x |
| DUST | O | O | O | O | x |

FIG. 24

| | | | | | |
|--------------------------------------|---|---|----|----|----|
| Ta ₂ N FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| Ta FILM THICKNESS(nm) | 3 | 5 | 10 | 30 | 60 |
| LAMINATION CYCLE(TIMES) | 7 | 7 | 7 | 7 | 7 |
| Cu/Al BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING BARRIER PROPERTIES | x | O | O | O | O |
| POST-BONDING ADHESION PROPERTIES | x | O | O | x | x |
| DUST | O | O | O | x | x |

FIG. 25
PRIOR ART

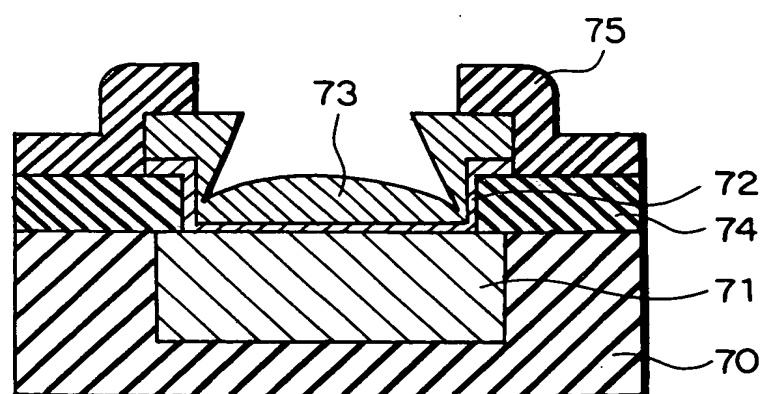


FIG. 26
PRIOR ART

